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Tables of Rate Constants for Gas Phase Chemical Reactions of Sulfur Compounds (1971-1979)

Francis Westley

Chemical Kinetics Division
Center for Thermodynamics and Molecular Science
National Measurement Laboratory
National Bureau of Standards
U.S. Department of Commerce
Washington, D.C. 20234

July 1980

Interim Report

Prepared for
Morgantown Energy Technology Center
Department of Energy
Morgantown, West Virginia 26505

and

Office of Standard Reference Data
National Bureau of Standards
Washington, D.C. 20234

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U.S. DEPARTMENT OF COMMERCE, Philip M. Klutznick, *Secretary*

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TABLES OF RATE CONSTANTS FOR GAS PHASE CHEMICAL REACTIONS OF SULFUR COMPOUNDS (1971-1979)*

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A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation $k = AT^{B}\exp(-E/RT)$. The table covers the reactions of sulfur containing molecules and free radicals - S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, CH_3SH, cy-CH_2CH_2S, $CH_3SCH_2\cdot$ and a number of thiols, thioethers and thioesters - with other compounds. The table includes 16 unimolecular, 187 bimolecular, and 11 termolecular reactions totalling 214 distinct chemical reactions. There are 348 distinct entries, distributed as follows: 26 for first order reactions, 294 for second order reactions and 28 for third order reactions. The kinetic data were compiled from 109 experimental papers and 6 critical reviews published between 1970 and 1979.

Key words: Arrhenius parameters, chemical kinetics, combustion, decomposition, free radicals, gas phase, hydrocarbons, hydrogen, nitrogen oxygen, rate of reaction, sulfur.

---

* This work was supported by the Department of Energy and by the Office of Standard Reference Data of the National Bureau of Standards.

INTRODUCTION

This publication consists of a table of rate constants for reactions of inorganic and organic sulfur compounds in the gas phase, as well as of their reactions with other bodies. The table is a compilation of rate constants given in 109 experimental papers and 6 critical reviews published between 1970 and 1979. Its purpose is to provide the kineticist and combustion modeler with a comprehensive and easy-to-use source on kinetic data for chemical processes involving sulfur compounds. The table gives 348 distinct reaction rate constants from the above mentioned sources. A list of references including the 115 papers, arranged alphabetically by author for each separate year, is appended at the end of the table.

For ease of reference the sulfur-containing reactant in a bimolecular or termolecular reaction is always placed first, so that a grouping of the reactions according to the standard order of sulfur compounds is obtained. However, 14 bimolecular reactions and one termolecular reaction involve two sulfur-containing reactants. For that reason, these 15 reactions are listed twice, the second time with the order of the sulfur-containing reactants reversed. (E.g.: $COS + S \rightarrow CO + S_2$ is also listed as: $S + COS \rightarrow S_2 + CO$.) As a result, the total number of tabulated entries is 363, although the real number of distinct entries is only 347. The arrangement of the tables and the standard order of chemical compounds are described in detail below, in the "Guidelines for the User".

The presentation of kinetic data is standardized and simplified as much as possible. Rate constants are expressed in terms of the modified Arrhenius equation $k = AT^B\exp(-E/RT)$. In general uncertainties are given only for the rate constant k itself and not for the individual

parameters in this equation. Sometimes an uncertainty is given for the value E/R and has been included in the uncertainty stated for the value of the rate constant. Rate constants are expressed in units of s^{-1}, $cm^3 mol^{-1} s^{-1}$, and $cm^6 mol^{-2} s^{-1}$ for reactions of first, second and third order respectively. Conversion tables for other units are appended at the end of this publication.

This publication is not the result of the effort of a single person, but of the whole staff of the Chemical Kinetics Division. My thanks to all of them. In particular, I wish to thank Dr. David Garvin, Deputy Director of the Center for Thermodynamics and Molecular Science, and Dr. Robert F. Hampson, Jr., Director of the Chemical Kinetics Information Center, for their more than helpful suggestions and constant guidance; Dr. Wing Tsang, Chief of the Chemical Kinetics Division, and Dr. John T. Herron of the Chemical Kinetics Division, for their encouragement; Dr. Bert R. Staples, Chief of the Electrolyte Data Center, for allowing us to program the tables through a computer; Mrs. Bettijoyce Molino and Mrs. Carla G. Messina from the Office of Standard Reference Data for applying the OMNIDATA and GPSDIC programs to the present tables; and Mrs. Janice L. Jones and Mrs. Delores E. Dorman for typing a difficult typescript with particular care.

GUIDELINES FOR THE USER

General

As pointed out above, the presentation of the kinetic data in this publication is an attempt to simplify and standardize them. Units of rate constants used in this table are the cubic centimeter, the mole and the second. The choice of a standard form for uncertainty limits is somewhat more complicated, but when a series of recommended rate constants is to be presented in a tabular form, the uncertainty limits can not be omitted, for an uncertainty assigned to the recommended value of a rate constant is an estimate by the evaluator of the absolute accuracy of the preferred value. It is to be emphasized that in the present tables the concern is with the overall uncertainty of a reaction rate constant and not with the expression of precision of a set of experimental measurements. Most of the uncertainty limits included in this table are uniform within the respective temperature range indicated. However, for a limited number of reactions, the data warrant or require variable limits. In such cases, a note under the respective data indicates for which interval of the temperature range there is a change in the uncertainty limits.

It is thought that the uncertainty limits expressed in the form of lower and upper k factors - f and F, respectively - are the most suitable for tabulation. Thus, if k_o is the central value of a rate constant the limits of reliability for the rate constant k_o are defined by the relationship:

$$fk_o < k < Fk_o \qquad (1)$$

i.e. multiplication of the central value k_o by f and F gives respectively the lower and upper reliability limits of the rate constant. In this

standardized formulation of uncertainty limits, the value of f is less than unity and the value of F is greater than unity.

However the k factors are not the only way to express the uncertainty limits of a rate constant and different authors use different forms to indicate the degree of reliability of a recommended rate constant. It follows that certain mathematical relationships are needed to translate the different forms of uncertainty limits into the standard form used in this table (lower and upper k factors). The formulas used to transform any form of uncertainty limits into the standard form were given and discussed at length in the introduction of a previous publication* and will not be repeated here.

Arrangement of the table

This publication is in two parts:

Part I. The table arranged in nine columns gives the chemical reaction, the order of reaction n, the "third body" collision partner M, the rate constants ratio k/k_{ref}, the temperature range in kelvins, the parameters A, B and E/R for the modified Arrhenius equation $k = AT^{B}exp(-E/RT)$ and the uncertainty limits expressed as k factors f and F.

Part II. The bibliography of part I, including the full references for the 109 experimental papers and 6 critical reviews from which the present table was compiled. Following the bibliography, two conversion tables for equivalent second and third order rate constant units are appended.

The arrangement of the table in part I is as follows:

Column 1 the chemical reaction indicating both the reactants and the products. In the same column, under each chemical reaction, the

---

* Westley, Francis, "Tables of Recommended Rate Constants for Chemical Reactions Occurring in Combustion", NBSIR 79-1941 (1979) (1st ed.); NSRDS-NBS 67 (1980) (2nd ed.).

names of the reactants are given. The chemical nomenclature adopted is the one used in the Chemical Substance Indexes of Chemical Abstracts. Alternative names are not given. The chemical names of the products are not given. The line with chemical names is indented with respect to the line above it. Under the chemical names, the short reference to the reviewer's book or article is given. It includes the last two digits of the year of the publication followed by the first three letters of the author's name. If two authors are given, a slash separates each author's three letters. Again, the short reference line is indented with respect to the line above it. e.g.:

78 MAR/HER indicates the experimental rate constant for the reaction between dimethyl sulfide and ozone, published by Martinez and Herron in 1978.

The last line of column 1, placed under the line including the short reference, begins with the heading NOTE:. It is given only when necessary and might include information about the dependence of k factors on temperature range, or the reaction taken as reference when a value for the ratio k/k_{ref} is given in column 3, or other information pertinent to the reaction indicated above. For a couple of reactions taken from Baulch, et al. (76 BAU/DRY) the relationship $k_1 = Kk_{-1}$ included in the note indicates that the rate constant was calculated from the equilibrium constant K and the rate constant k_{-1} of the reverse reaction. In such cases, the author usually gives the rate constant of the reverse reaction immediately after the data for the forward reaction. The arrangement of the present table based on the standard order, does not allow the forward rate constant of a reaction to be followed immediately by its reverse rate constant. The reader will have to locate the rate constant of a reverse in its proper place in the table.

Column 2, with the heading n, indicates the order of the reaction displayed in column 1. The value of n is 1, 2, or 3, which defines the proper standard units for the reactions, as follows:

1	for first order reactions	s^{-1}
2	for second order reactions	$cm^3mol^{-1}s^{-1}$
3	for third order reactions.	$cm^6mol^{-2}s^{-1}$

The reaction order is indicated for every reaction included in the table and the digit indicating its value is aligned with the short reference.

Column 3, with the heading M, defines the inert reaction partner ("third body") when the chemical reaction displayed in column 1 includes the letter M. Most of the third bodies displayed in column 3 include no more than three characters (e.g.: Ar, He, H_2O, N_2, N_2O, SO_2, SO_3, CO_2). For the reaction $SO_2 + OH + M \rightarrow HOSO_2 + M$ the third body, a mixture of N_2 and O_2, is indicated in the note, in column 1. No indication is given if M is undefined in the paper. When displayed, the third body is aligned with the short reference and the reaction order.

Column 4, with the heading k/k_{ref}, gives the ratio of the rate constant of the reaction indicated in column 1 and the rate constant of a reference reaction. In most cases this ratio is a dimensionless number. However, when the order of the reaction indicated in column 1 is different from the order of the reference reaction, the ratio of the rate constants is no longer dimensionless and the expression for the ratio of rate constants is not given in column 3 (for lack of space), but in the note, at the end of column 1. The reference reaction is always indicated in the notes. The dimensionless rate ratios given in column 3 are aligned with the short reference given in column 1 and with the reaction order given in column 2.

Column 5, with the heading T/K, gives the temperature range of validity for the corresponding rate parameters. For some reactions only one temperature is given, meaning that the reaction was studied only at one temperature. If no temperature is indicated, it means that the kinetic parameters of the corresponding reaction are valid throughout. The data estimated by Benson and Golden in their report "Estimating the Kinetics of Combustion" (75 BEN/GOL) are in this category. The temperatures are aligned with the short references given in column 1, as well as with the reaction order given in column 2.

Column 6, with the heading A, gives the value of A for the equation $k = AT^{B}exp(-E/RT)$. A is expressed as a number less than 10 followed by the exponent in parenthesis. e.g., 3.5 (+ 14) should be read as $3.5 \times 10^{+14}$. The coefficient of the A factor has no more than one digit after the decimal point. The units of the A factor are the same as for the rate constant. For those cases when the recommended value is only for one temperature, the entry under this column is in fact the value of the rate constant k at this temperature. The data for the A factor are aligned with the short reference and reaction order information. If a dash appears in this column, it means that no A factor value was reported by the evaluator for the corresponding reaction. In such a case a rate ratio is given in column 4.

Column 7, with the heading B, gives the value of B for the equation $k = AT^{B}exp(-E/RT)$. The value of B usually lies between 0 and 4, negative or positive. No more than one digit is given after the decimal dot. A dash in this column means that no B value was reported by the evaluator. The data for B are aligned with the short reference and reaction order information.

Column 8, with the heading E/R, indicates the value of E/R for the equation $k = AT^{B}\exp(-E/RT)$. Since E is the activation energy in cal mol^{-1} and R the gas constant with a value of 1.987 cal mol^{-1} K^{-1}, it follows that the units of E/R are kelvins. The values given in column 5 for E/R may vary from 0 to over 100000 kelvins. The E/R values may be positive or negative. Some of the E/R values included in the table are followed by an uncertainty with plus or minus signs. As pointed out in the introduction, these uncertainties may be ignored, as they are included in the lower and upper k factors indicated in the right column of the table. A dash in this column means that no E/R value was reported by the evaluator. The values for the E/R factor are aligned with the short reference and reaction order information.

Column 9, with the heading "k factors" and two subheadings, "f" and "F", indicates the two uncertainty k factors, the lower factor f in the left subcolumn and the upper factor F in the right subcolumn. To find the uncertainty limits of a reaction, its rate constant is to be multiplied by the two factors, as shown in (1): $fk_0 < k < Fk_0$. The values of both factors are always positive. If no uncertainty limits are indicated by the evaluator, both subcolumns of the column 6 are left blank. The k factors are aligned with the short reference and reaction order information.

Ordering of chemical reactions.

The general rule for ordering the chemical reactions listed in column 1 of the table is the standard order of arrangement as described in NBS Technical Note 270-3*. A detailed discussion of this rule was presented in the introduction to the publication noted in the preceding footnote (NBSIR 79-1941/1979, or NSRDS-NBS 67/1980) - and will

* Wagman, D.D., Evans, W.H., Parker, V.B., Halow, I., Bailey, S.M., and Schumm, R.H., "Selected Values of Chemical Thermodynamic Properties," NBS Tech. Note 270-3 pgs. 5, 16, 22 (1968).

not be repeated here. It suffices to say that this rule is applied to the first reactants of the reactions listed in this table, as well as to the reactants following the first, and that the first reactant of a reaction takes precedence over the following ones. The compounds listed in the Table of Contents, which give only the first reactants of the chemical reactions included in this work, are in the standard order (S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, cy-CH_2CH_2S, etc.) and are each part of the S-O-H-C system. (The first reactant always includes an S atom, and may include any of the O, H, or C atoms). The second, or the third reactants may include any of the O, H, S, N, or C atoms, and this sequence - arranged according to the standard order - defines the O-H-S-N-C system.

A number of second and third order reactions includes a second and - respectively - third body M. For this type reactions, M will always be placed after all other reactants. (e.g.: $SO_3 + M \rightarrow SO_2 + O + M$, or $SO + O + M \rightarrow SO_2 + M$).

Most of the chemical reactions included in the table are balanced. There are a number of reactions with unspecified products. In such a case, the word "products" appears after the arrow (e.g.: $SO_2 + HO_2 \rightarrow$ products).

Display of Chemical Reactions and Formulae

In order to define the reaction products, the reactants are written using semi-structural formulas. All saturated normal hydrocarbons are written so as to show separately each methyl and methylene group in the chain: CH_4, CH_3CH_3, $CH_3CH_2CH_3$. Unsaturated hydrocarbons are written so as to show the position of double or triple bonds. The unpaired electron

of an alkyl radical is always indicated, with the exception of Methyl free radical, e.g.:

Methyl free radical	CH_3 (no dot)
Ethyl, 1-methyl-, free radical (Isopropyl)	$(CH_3)_2CH\cdot$
Methyl, hydroxy-, free radical	$\cdot CH_2OH$
Methylthio free radical	$CH_3S\cdot$

If the unpaired electron of an alkyl radical belongs to a carbon in the middle of the chain, it is indicated inside a parenthesis following the carbon atom, e.g.:

Propyl, 1-methyl-, free radical (sec-Butyl) $CH_3CH_2CH(\cdot)CH_3$

If the oxygen atom of an oxy radical is attached to the terminal carbon atom, the radical is written in the usual manner: CH_3O. If the oxygen atom of the oxy radical is attached to a C atom in the middle of the chain, then the oxygen atom, together with the unpaired electron, are inside a parenthesis following the C atom: $(CH_3)_2C(O\cdot)CH_2CH_3$. The rules for writing peroxo, and other free radicals are the same as for the oxy free radicals: $CH_3O_2\cdot$, CH_3S.

Atoms, like O, H, S, N, C, and simple radicals like OH, HO_2, SH, NH, CH, CH_2, CH_3, CS, CN are written without dot.

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (ln K)	k factors f	k factors F
$S + O_2 \rightarrow SO + O$									
Sulfur atom + Oxygen molecule									
72 DAV/KLE1	2			252-423	1.3(+12)	0	0±50 1	0.9	1.2
72 DON/LII	2			295	1.0(+12)	-	-	0.8	1.2
75 CLY/IOW	2			298	9.0(+11)	-	-	0.8	1.2
76 BOU/DRY	2			250-450	1.4(+12)	0	0±50	0.5	1.5
NOTE: Recommended k.									
72 CLY/WHI	2			296-410	1.0(+12)	0	-153±108	0.7	1.3
$S + O_3 \rightarrow SO + O_2$									
Sulfur atom + Ozone									
75 CLY/IOW	2			298	7.2(+12)	-	-	0.7	1.3
$S + H_2 \rightarrow SH + H$									
Sulfur atom + Hydrogen molecule									
76 BOU/DRY	2			298	1.3(-1)	-	-	0.5	1.5
NOTE: $k_1 = Kk_{-1}$. Recommended k.									
75 BEN/GOL	2				2.5(+12)	0.5	13640		
NOTE: Semi-empirical evaluation.									
$S^*(^1D) + H_2 \rightarrow$ products									
Sulfur atom + Hydrogen molecule									
72 LII/DAL	2		0.22	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products.									
$S + OH \rightarrow SO + H$									
Sulfur atom + Hydroxyl free radical									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
72 JOU/LEE	2			298	4.0(+13)	-	-	0.8	1.2
$S + OH \rightarrow SH + O$									
Sulfur atom + Hydroxyl free radical									
75 BEN/GOL	2				1.3(+12)	0.5	12700		
NOTE: Semi-empirical evaluation.									
$S + S_2 \rightarrow S_2 + S$									
Sulfur atom + Sulfur dimer									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + SO \rightarrow S_2 + O$									
Sulfur atom + Sulfur monoxide									
75 BEN/GOL	2				6.3(+11)	0.5	11500		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
S + SO → SO + S									
Sulfur atom + Sulfur monoxide									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
S + SH → S_2 + H									
Sulfur atom + Mercapto free radical									
75 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-emprical evaluation.									
S + SH → SH + S									
Sulfur atom + Mercapto free radical									
75 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
S + N_2 → NS + N									
Sulfur atom + Nitrogen molecule									
75 BEN/GOL	2				4.0(+12)	0.5	55200		
NOTE: Semi-empirical evaluation.									
$S^*(^1D)$ + N_2 → products									
Sulfur atom + Nitrogen molecule									
72/LIT/DAL	2		0.062	300	-	-	-		
E: k_{ref}: $S^*(^1D)$ + CH_2=CH_2 → products									
S + NO → SO + N									
Sulfur atom + Nitrogen oxide(NO)									
75 BEN/GOL	2				4.0(+11)	0.5	17260		
NOTE: Semi-empirical evaluation.									
S + NO → NS + O									
Sulfur atom + Nitrogen oxide(NO)									
75 BEN/GOL	2				1.0(+12)	0.5	17365		
NOTE: Semi-empirical evaluation.									
$S^*(^1D)$ + NO → products									
Sulfur atom + Nitrogen oxide(NO)									
72 LIT/DAL	2		0.68		-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + CH_2=CH_2 → products									
S + NO + M → SNO + M									
Sulfur atom + Nitrogen oxide(NO)									
70 VAN/ORI	2	CO2		298	9.3(+12)	-	-	0.8	1.2
NOTE: Limiting high-pressure k.	3	CO_2		298	1.9(+17)	-	-		
NOTE: k_0 (low pressure).									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$S + NO_2 \rightarrow SO + NO$									
Sulfur atom + Nitrogen oxide(NO_2)									
ZS CLY/10W	2			298	3.7(+13)	-	-	0.8	1.2
ZZ CLY/WUY	2			296-410	3.0(+13)	0	-84±60	0.8	1.2
$S^*(^1D) + N_2O \rightarrow NS + NO$									
Sulfur atom + Nitrogen oxide(N_2O)									
ZZ LII/DOL	2		0.1	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products (Approximate ratio).									
$S + NH \rightarrow SH + N$									
Sulfur atom + Inidouen free radical									
ZS BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$S^*(^1D) + CO \rightarrow$ products									
Sulfur atom + Carbon monoxide									
ZZ LII/DOL	2		0.19	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S^*(^1D) + CO_2 \rightarrow$ products									
Sulfur atom + Carbon dioxide									
ZZ LII/DOL	2		0.24	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S^*(^1D) + CH_4 \rightarrow CH_3SH$									
Sulfur atom + Methane									
ZZ LII/DOL	2		0.076	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D) + CH_2=CH_2 \rightarrow$ products									
$S + CS \rightarrow CS + S$									
Sulfur atom + Carbon monosulfide free radical									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + CS \rightarrow S_2 + C$									
Sulfur atom + Carbon monosulfide free radical									
ZS BEN/GOL	2				1.6(+12)	0.5	40463		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$S + CS + M \rightarrow CS_2 + M$									
Sulfur atom + Carbon monosulfide free radical									
Z6 BAU/DRY	3			1500 ±700	8.7(+13)	0	-4370	0.5	1.5
NOTE: $k_1 = Kk_{-1}$. Recommended k									
$S + CS_2 \rightarrow S_2 + CS$									
Sulfur atom + Carbon disulfide									
Z6 BAU/DRY	2			298	3.9(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
$S + CDS \rightarrow S_2 + CO$									
Sulfur atom + Carbon oxide sulfide									
Z2 JAK/AUG	2			298	1.1(+10)	-	-		
NOTE: Evaluation.									
Z4 KLE/DAV	2			233-245	9.2(+11)	0	1025±60	0.9	1.1
Z6 BAU/DRY	2			230-2600	1.7(+12)	0	2050±230	0.3	3.0
NOTE: Recommended k.									
$S^*(^1D) + COS \rightarrow S_2 + CO$									
Sulfur atom + Carbon oxide sulfide									
Z2 LIJ/DAL	2		1.5	300	-	-	-	0.7	1.3
NOTE: k_{ref}: $S^*(^1D) + CH_2{=}CH_2 \rightarrow$ products									
$S + CN \rightarrow CS + N$									
Sulfur atom + Cyanogen free radical									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + C_2 \rightarrow CS + C$									
Sulfur atom + Carbon dimer									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S + CH{=}CH \rightarrow cy\text{-}CH{=}CHS$									
Sulfur atom + Ethyne									
Z1 SIP/ORG	2			298-450	-	-	-		
NOTE: $k/k_{ref} = 6.2\exp(-1007/T)$.									
k_{ref}: $S + CH_2{=}CH_2 \rightarrow cy\text{-}CH_2CH_2S$									
Conventional photolysis method.									
Z2 KLE/DAR	2			298	1.7(+11)	-	-		
NOTE: Recommended k.									
$S + CH{\equiv}CH \rightarrow$ products									
Sulfur atom + Ethyne									
Z8 VAN/SAE	2			298-484	3.4(+13)	0	1510±200	0.4	1.6
$S + CD{\equiv}CD \rightarrow$ products									
Sulfur atom + Ethyne-d_2									
Z8 VAN/SAE	2			298	2.3(+11)	-	-	0.0	1.2

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
S + CH_2=CH_2 → cy-CH_2CH_2S									
Sulfur atom + Ethene									
Z1 CDN/VAN	2			298	9.0(+11)	-	-	0.9	1.1
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2		1.0	298-450	-	-	-		
NOTE: k_{ref}: S + CH_2=CH_2 → cy-CH_2CH_2S Conventional photolysis method.									
Z2 DAV/KLE2	2			218-442	4.3(+12)	0	795±40	0.9	1.1
Z2 KER/ROB	2			298	8.1(+11)	-	-		
NOTE: Recommended k.									
S + CD_2=CH_2 → cy-CD_2CH_2S									
Sulfur atom + Ethene-1,1-d_2									
Z1 SIR/O'C	2		1.07	298-450	-	-	-		
NOTE: k_{ref}: S + CH_2=CH_2 → cy-CH_2CH_2S Conventional photolysis method.									
S + cis-CHD=CHD → cy-CHDCHDS									
Sulfur atom + cis-Ethene-1,2-d_2									
Z1 SIR/O'C	2		1.04	298-450	-	-	-		
NOTE: k_{ref}: S + CH_2=CH_2 → cy-CH_2CH_2S Conventional photolysis method.									
S + CD_2=CD_2 → cy-CD_2CD_2S									
Sulfur atom + Ethene-d_4									
Z1 SIR/O'C	2		1.14	298-450	-	-	-		
NOTE: k_{ref}: S + CH_2=CH_2 → cy-CH_2CH_2S Conventional photolysis method.									
$S^*(^1D)$ + CH_3CH_3 → products									
Sulfur atom + Ethane									
Z2 LII/DOL	2		0.17	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + CH_2=CH_2 → products									
S + cy-CH_2CH_2S → S_2 + CH_2=CH_2									
Sulfur atom + Thiirane									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.3exp(+906/T)									
k_{ref}: S + CH_2=CH_2 → cy-CH_2CH_2S Conventional photolysis method.									
Z3 KLE/DAV1	2			298-355	2.7(+13)	0	0	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
S + $CH_3C{\equiv}CH$ → cy-$(CH_3)C{=}CHS$									
Sulfur atom + 1-Propyne									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 6.2exp(-453/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.1(+12)	-	-		
NOTE: Recommended k.									
S + $CH_3C{\equiv}CH$ → products									
Sulfur atom + Propyne									
Z0 YAN/SAE	2			298-449	2.0(+13)	0	453±100	0.4	1.6
S + $CH_3CH{=}CH_2$ → cy-$(CH_3)CHCH_2S$									
Sulfur atom + Propene									
Z1 COH/YAN	2			298	6.0(+12)	-	-	0.8	1.2
NOTE: Flash photolysis method.									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 1.0exp(+574/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	5.0(+12)	-	-		
NOTE: Recommended k.									
Z2 KER/PAR	2		6.9	298	-	-	-		
NOTE: k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Z3 KLE/DAV2	2			214-500	3.6(+12)	0	190±45	0.2	5.2
$S^*(^1D)$ + $CH_3CH{=}CH_2$ → cy-$(CH_3)CHCH_2S$									
Sulfur atom + Propene									
Z2 KER/PAR	2		1.7	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
S + cy-$(CH_3)CHCH_2S$ → S_2 + $CH_3CH{=}CH_2$									
Sulfur atom + Thiirane,methyl-									
Z1 SIR/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.4exp(+1057/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
S + $CH_3CH_2C{\equiv}CH$ → products									
Sulfur atom + 1-Butyne									
Z0 YAN/SAE	2			298	3.3(+12)	-	-	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
S + $CH_3C{\equiv}CCH_3$ → cy-$(CH_3)C{=}C(CH_3)S$									
Sulfur atom + 2-Butyne									
Z1 STR/O'C				298-450	–	–	–		
NOTE: k/k_{ref}: 2.7exp(+654/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.9(+13)	–	–		
NOTE: Recommended k.									
S + $CH_3C{\equiv}CCH_3$ → products									
Sulfur atom + 2-Butyne									
Z0 VAN/SAF	2			298	1.6(+13)	–	–	0.9	1.1
S + $CH_2{=}CHCH{=}CH_2$ → cy-$(CH_2{=}CH)CHCH_2S$									
Sulfur atom + 1,3-Butadiene									
Z1 STR/O'C	2			298-450	–	–	–		
NOTE: k/k_{ref}: 2.4exp(+102?/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	6.0(+13)	–	–		
NOTE: Recommended k.									
S + $CH_3CH_2CH{=}CH_2$ → cy-$(CH_3CH_2)CHCH_2S$									
Sulfur atom + 1-Butene									
Z1 COH/VAN	2			298	9.0(+12)	–	–	0.9	1.1
NOTE: Flash photolysis method.									
Z1 STR/O'C	2			298-450	–	–	–		
NOTE: k/k_{ref}: 0.75exp(+866/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	9.3(+12)	–	–		
NOTE: Recommended k.									
	2		10.0	298	–	–	–		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
Z3 KLE/DAV2	2			216-475	4.5(+12)	0	180±45	0.1	4.0
S + cis-$CH_3CH{=}CHCH_3$ → cy-$(CH_3)CHCH(CH_3)S$									
Sulfur atom + cis-2-Butene									
Z1 STR/O'C	2			298-450	–	–	–		
NOTE: k/k_{ref}: 0.53exp(+1050/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.4(+13)	–	–		
NOTE: Recommended k.									
	2		16.0	298	–	–	–		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
S + cis-$CH_3CH{=}CHCH_3$ → products									
Sulfur atom + cis-2-Butene									
Z1 DAV/KLE	2			219-500	2.8(+12)	0	-116±45	0.9	1.1
S + trans-$CH_3CH{=}CHCH_3$ → cy-$(CH_3)CHCH(CH_3)$B									
Sulfur atom + trans-2-Butene									
Z1 CON/VAN	2			298	1.2(+13)	-	-	0.8	1.2
NOTE: Flash photolysis method.									
Z1 SIB/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.65exp(+1010/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Conventional photolysis method.									
Z2 KER/PAR	2			298	1.4(+13)	-	-		
NOTE: Recommended k.									
	2		20.0	298	-	-	-		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
S + $(CH_3)_2C{=}CH_2$ → cy-$(CH_3)_2CCH_2$B									
Sulfur atom + 1-Propene,2-methyl-									
Z1 CON/VAN	2			298	3.6(+13)	-	-	0.9	1.1
NOTE: Flash photolysis method.									
Z1 SIB/O'C	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.97exp(+1190/T)									
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Conventional photolysis method.									
Z2 KER/PAR	2			298	4.0(+13)	-	-		
NOTE: Recommended k.									
	2		50.0	298	-	-	-		
k_{ref}: S + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
$S^*(^1D)$ + $(CH_3)_2C{=}CH_2$ → cy-$(CH_3)_2CCH_2$B									
Sulfur atom + 1-Propene, 2-methyl-									
Z2 KER/PAR	2		3.5	300	-	-	-		
NOTE: k_{ref}: $S^*(^1D)$ + $CH_2{=}CH_2$ → cy-CH_2CH_2B									
Recommended ratio.									
S + $CH_3CH_2C{\equiv}CCH_3$ → products									
Sulfur atom + 2-Pentyne									
Z1 VAN/SAE	2			298	1.8(+13)	-	-	0.8	1.2
S + $CH_3CH_2CH_2CH{=}CH_2$ → cy-$(CH_3CH_2CH_2)CHCH_2$B									
Sulfur atom + 1-Pentene									
Z2 KER/PAR	2			298	8.1(+12)	-	-		
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
S + $CH_3CH_2C(CH_3)=CH_2$ → cy-$(CH_3CH_2)C(CH_3)CH_2$S									
Sulfur atom + 1-Butene, 2-methyl-									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.78exp(+1424/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	7.4(+13)	-	-		
NOTE: Recommended k.									
S + $CH_3CH=C(CH_3)_2$ → cy-$(CH_3)CHC(CH_3)_2$S									
Sulfur atom + 2-Butene, 2-methyl-									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.51exp(+1515/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	6.5(+13)	-	-		
NOTE: Recommended k.									
	2		56.0	298	-	-	-		
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Recommended ratio.									
S + $(CH_3)_2C=C(CH_3)_2$ → cy-$[(CH_3)_2]CC[(CH_3)_2]$S									
Sulfur atom + 2-Butene, 2,3-dimethyl-									
71 CON/VAN	2			298	>6.2(+13)	-	-	0.9	1.1
NOTE: Lower limit k.									
Flash photolysis method.									
71 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref}: 0.50exp(+1690/T)									
k_{ref}: S + $CH_2=CH_2$ → cy-CH_2CH_2S									
Conventional photolysis method.									
72 KER/PAR	2			298	8.5(+13)	-	-		
NOTE: Recommended k.									
S + $(CH_3)_2C=C(CH_3)_2$ → products									
Sulfur atom + 2-Butene, 2,3-dimethyl-									
73 DAV/KLE	2			252-500	2.8(+12)	0	-650±115	0.6	1:4
S_2 + O → S + SO									
Sulfur dimer + Oxygen atom									
75 BEN/COL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
S_2 + H → S + SH									
Sulfur dimer + Oxygen atom									
75 BEN/COL	2				7.9(+12)	0.5	8355		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
$S_2 + S \rightarrow S + S_2$									
Sulfur dimer + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$S_2 + S_2 + M \rightarrow S_4 + M$									
Sulfur dimer									
Z2 LAN/OLD	3	CO_2		293	9.1(+17)	-	-	0.1	10.
Z3 LAN/OLD	3	CO_2		293	3.6(+18)	-	-		
NOTE: Given with caution.									
$S_2 + N \rightarrow S + NS$									
Sulfur dimer + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$S_2 + C \rightarrow S + CS$									
Sulfur dimer + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO + O \rightarrow O + SO$									
Sulfur monoxide + Oxygen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO + O \rightarrow S + O_2$									
Sulfur monoxide + Oxygen atom									
Z5 BEN/GOL	2				2.0(+11)	0.5	2770		
NOTE: Semi-empirical evaluation.									
$SO + O + M \rightarrow SO_2 + M$									
Sulfur monoxide + Oxygen atom									
Z1 MIY/IAK1	3	Ar		298	7.3(+16)	-	-	0.9	1.1
Z6 BAU/DRY	3			298	6.7(+13)	-	-	0.7	1.3
NOTE: Recommended k.									
$SO + O_2 \rightarrow SO_2 + O$									
Sulfur monoxide + Oxygen molecule									
Z6 BAU/DRY	2			440-2100	4.5(+11)	0	3250±590	0.3	1.7
NOTE: Recommended k.									
$SO + O_3(v=n) \rightarrow SO_2^* + O_2$									
Sulfur monoxide + Ozone									
Z4 KAL/DRA	2		2.4	300	-	-	-	0.8	1.3
NOTE: k_{ref}: $SO + O_3 \rightarrow SO_2^* + O_2$									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
SO + H → O + SH									
Sulfur monoxide + Hydrogen atom									
ZS BEN/GOL	2				6.3(+11)	0.5	19930		
NOTE: Semi-empirical evaluation.									
SO + H → S + OH									
Sulfur monoxide + Hydrogen atom									
ZS BEN/GOL	2				4.0(+12)	0.5	11200		
NOTE: Semi-empirical evaluation.									
SO + OH → SO$_2$ + H									
Sulfur monoxide + Hydroxyl free radical									
ZZ JOU/LEB	2			298	5.1(+13)	-	-	0.8	1.2
SO + S → O + S$_2$									
Sulfur monoxide + Sulfur atom									
ZS BEN/GOL	2				6.3(+11)	0.5	11500		
NOTE: Semi-empirical evaluation.									
SO + S → S + SO									
Sulfur monoxide + Sulfur atom									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
SO + SO → SO$_2$ + S									
Sulfur monoxide									
ZS CUU/CAL	2			298	5.0(+8)	-	-	0.2	1.8
SO + SO$_3$ → SO$_2$ + SO$_2$									
Sulfur monoxide + Sulfur trioxide									
ZS CUU/CAL	2			298	1.2 +9)	-	-	0.4	1.6
SO + N → O + NS									
Sulfur monoxide + Nitrogen atom									
ZS BEN/GOL	2				1.6(+12)	0.5	8254		
NOTE: Semi-empirical evaluation.									
SO + N → S + NO									
Sulfur monoxide + Nitrogen atom									
ZS BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
SO + NO$_2$ → SO$_2$ + NO									
Sulfur monoxide + Nitrogen oxide(NO$_2$)									
ZA MIY/IAK2	2			890	1.2(+16)	-	-	0.9	1.1
SO + C → O + CS									
Sulfur monoxide + Carbon atom									
ZS BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$SO + C \rightarrow S + CO$									
Sulfur monoxide + Carbon atom									
ZS MCN/COL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
$SO_2 + O \rightarrow SO + O_2$									
Sulfur dioxide + Oxygen atom									
ZG BAU/DRY	2			440-2100	1.3(+14)	-0.5	9980	0.3	1.7
NOTE: Recommended k. $k_1 = Kk_{-1}$									
$SO_2 + O + M \rightarrow SO_3 + M$									
Sulfur dioxide + Oxygen atom									
ZA AIK/PIII	3	N_2O		299-392	3.3(+16)	0	1000±200		
ZS WES/DEU2	3	He		248-415	3.3(+16)	0	1400±50	0.8	1.2
	3	He		297	3.0(+14)	-	-	0.9	1.1
NOTE: M_{eff}: He(1.0)									
	3	SO_2		297	2.9(+15)	-	-	0.7	1.3
M_{eff}: SO_2(9.5)									
	3	N_2		297	7.2(+14)	-	-	0.9	1.1
M_{eff}: N_2(2.4)									
ZA AIK/PIII	3	Ar		299-400	1.1(+16)	0	1010±150		
	3	N_2		300	5.0(+14)	-	-	0.8	1.2
	3	SO_2		299	3.4(+15)	-	-	0.7	1.3
ZZ MER/LEV	3			1685	7.4(+14)	-	-		
$SO_2 + O_2^*(^1\Delta_g) \rightarrow SO_3 + O$									
Sulfur dioxide + Oxygen molecule									
ZA DUM	2			298	1.3(+8)	-	-		
$SO_2^* + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
ZA PAR/DEI	2		0.05	298	-	-	-		
NOTE: k_{ref}: $SO_2^* \rightarrow {}^1SO_2$, or SO_2 (SO_2^* is a singlet formed on absorption).									
$^1SO_2 + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
ZA PAR/DEI	2		0.29	298	-	-	-		
NOTE: k_{ref}: $^1SO_2 + SO_2 \rightarrow$ products ($^1SO_2$ is a fluorescent singlet).									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$SO_2{}^*(^3B_1) + O_2 \rightarrow$ products									
Sulfur dioxide + Oxygen molecule									
70 PAR/HEI	2		0.36	298	-	-	-		
NOTE: k_{ref}: $SO_2{}^*(^3B_1) + SO_2 \rightarrow$ products									
$SO_2 + O_3 \rightarrow SO_3 + O_2$									
Sulfur dioxide + Ozone									
74 DAV/PRU	2			300	(6.0(+1)	-	-		
NOTE: Upper limit k.									
$SO_2 + H + M \rightarrow HSO_2 + M$									
Sulfur dioxide + Hydrogen atom									
76 PAU/DRY	3			1660-2120	5.1(+15)	-	-	0.5	1.5
NOTE: Recommended k.									
$SO_2 + OH(v=9) \rightarrow HSO_3$									
Sulfur dioxide + Hydroxyl free radical									
72 WOR/COL	2			298	)1.4(+10)	-	-	0.8	1.2
NOTE: Lower limit k. Unreported T assumed to be 298K.									
$SO_2 + OH + M \rightarrow HOSO_2 + M$									
Sulfur dioxide + Hydroxyl free radical									
74 COX2	2			294	3.6(+11)	-	-	0.9	1.1
NOTE: Evaluation. Rate constant expressed as k[M] with M = $N_2 + O_2$ at 1 atm.									
75 COS/DAV	2	N_2		298	3.6(+11)	-	-		
NOTE: Limiting high-pressure k (760 torr).									
	3	N_2		298	5.8(+16)	-	-		
k_0 (low pressure: (20 torr).									
75 COR/MUL1	2	H_2O		435	1.1(+12)	-	-	0.9	1.1
NOTE: In an atmosphere of water vapor.									
75 WAR/WAY	3	Ar		298	1.6(+17)	-	-	0.7	1.3
	3	N_2		298	2.6(+17)	-	-	0.9	1.1
76 AIK/PER3	2	Ar		298	4.0(+11)	-	-	0.9	1.1
NOTE: At 760 torr.									
	2	Ar		298	5.0(+11)	-	-		
Limiting high-pressure k.									
	3	Ar		298	5.9(+16)	-	-	0.8	1.2
k_0 (low-pressure k).									
ZZ COS/ION	2	N_2		297	3.6(+11)	-	-		
NOTE: Limiting high-pressure k (760 torr).									
	3	N_2		297	5.8(+16)	-	-		
k_0 (low-pressure k).									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
	3	N_2		253-297	5.0(+14)	0	-1410		
k_0 (low pressure). On the basis of k_0(297) and E_a experimental values.									
	3	N_2		253-297	2.5(+29)	-5.1	0		
k_0 (low-pressure k). Alternative T-dependent expression.									
22 DAV/RAV	2	N_2		298	5.4(+11)	-	-	0.8	1.3
NOTE: Unreported T assumed to be 298K.									
$SO_2 + HO_2 \rightarrow SO_3 + OH$									
Sulfur dioxide + Hydroperoxyl free radical									
23 PAY/SII	2			300	5.2(+8)	-	-	0.8	1.2
NOTE: Evaluation.									
24 LLO	2			300	5.2(+8)	-	-	0.9	1.2
NOTE: Evaluation. Ratio data versus k_{ref} for reaction $HO_2 + HO_2 \rightarrow H_2O_2 + O_2$									
22 BUR/CLI				298	(1.2(+7)	-	-		
NOTE: Upper limit k.									
$SO_2 + HO_2 \rightarrow$ products									
Sulfur dioxide + Hydroperoxyl free radical									
22 GRA/WIN	2			300	(6.0(+5)	-	-		
NOTE: Upper limit k.									
$SO_2 + HO_2 + M \rightarrow HO_2SO_2 + M$									
Sulfur dioxide + Hydroperoxyl free radical									
22 BUR/CLI	3	He		298	(1.5(+17)	-	-		
NOTE: Upper limit k.									
$SO_2 + SO_2^*(^1B_1) \rightarrow SO^*(^1\Delta_g, ^3\Sigma^-) + SO_3$									
Sulfur dioxide									
25 CHO/CAL	2			298	2.2(+12)	-	-	0.8	1.2
$SO_2 + SO_2^*(^3B_1) \rightarrow SO + SO_3$									
Sulfur dioxide									
20 MAR/BLI	2			298	2.0(+14)	-	-		
NOTE: In an atmosphere of water vapor. (Approximate k).									
$SO_2 + SO_2^*(^3B_1) \rightarrow SO^*(^3\Sigma^-) + SO_3$									
Sulfur dioxide									
25 CHO/CAL	2			298	4.2(+10)	-	-	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f F
$SO_2 + NO_2 \rightarrow SO_3 + NO$								
Sulfur dioxide + Nitrogen oxide(NO_2)								
Z1 ARM/CUL	2			703-1193	6.3(+12)	0	13950	
ZZ EBE/COL	2			430-1850	6.3(+12)	0	16000	
NOTE: Extended validity of k reported in Z1 ARM/CUL (above), up to 2000K.								
$SO_2 + NO_2^* \rightarrow$ products								
Sulfur dioxide + Nitrogen oxide(NO_2)								
Z0 IWA/PRE	2			298	8.2(+10)	-	-	
NOTE: At 50 torr.								
$SO_2 + NO_3 \rightarrow SO_3 + NO_2$								
Sulfur dioxide + Nitrogen oxide(NO_3)								
Z5 DOU/COL	2			300	(4.2(+3)	-	-	
NOTE: Upper limit k.								
$SO_2 + N_2O_5 \rightarrow SO_3 + N_2O_4$								
Sulfur dioxide + Nitrogen oxide(N_2O_4)								
Z5 DOU/COL	2			300	(2.5(+1)	-	-	
NOTE: Upper limit k.								
$^1SO_2^* + CO \rightarrow SO + CO_2$								
Sulfur dioxide + Carbon monoxide								
Z3 CEH/DEI	2			300	-	-	-	
NOTE: k_{ref}: $^1SO_2^* + SO_2 \rightarrow$ products.								
$k/k_{ref} = 5.0 \times 10^{-3}$ (at 2537 A^0)	2			300	-	-	-	
$k/k_{ref} = 1.5 \times 10^{-3}$ (at 3130 A^0)								
$SO_2^* + CO \rightarrow SO + CO_2$								
Sulfur dioxide + Carbon monoxide								
Z3 CEH/DEI	2			300	-	-	-	
NOTE: k_{ref}: $SO_2^* \rightarrow$ products								
$k/k_{ref} = 2.2 \times 10^{-5}$ (3130 to 3261 A^0)								
(SO_2^* is a vibrationally excited singlet).								

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$SO_2^{**} + CO \rightarrow SO + CO_2$									
Sulfur dioxide + Carbon monoxide									
73 CEH/UEI	2			300	-	-	-	0.7	1.4
NOTE: k_{ref}: $SO_2^{**} \rightarrow SO_2$									
$k_{ref} = 1.8 \times 10^{-5}$ (2537 to 3261 A°)									
(SO_2^{**} is a chemically active triplet).									
$SO_2 + CO + M \rightarrow$ products									
Sulfur dioxide + Carbon monoxide									
71 BAU/JEE	2	Ar		1770-2453	2.7(+12)	0	24300±600	0.8	1.3
NOTE: At 27-170 torr pressure.									
$SO_2 + CH_3 + M \rightarrow CH_3SO_2 + M$									
Sulfur dioxide + Methyl free radical									
73 JAM/KER	2			298	1.8(+11)	-	-	0.9	1.1
NOTE: Limiting high-pressure k.									
$SO_2 + CH_3O_2 \cdot \rightarrow CH_3O_2SO_2$									
Sulfur dioxide + Methyldioxy free radical									
79 SAN/GIM	2			298	4.9(+9)	-	-	0.9	1.1
77 SIM/UEI	2		0.0025	296	-	-	-	0.8	1.2
NOTE: k_{ref}: $NO + CH_3O_2 \cdot \rightarrow NO_2 + CH_3O \cdot$									
$SO_2 + CH_3O_2 \cdot \rightarrow$ products									
Sulfur dioxide + Methyldioxy free radical									
79 KAN/NCG	2			296	3.2(+9)	-	-	0.8	1.2
NOTE: Best k estimate, based on apparent rate constant ($k_{app} \approx 2k$).									
$SO_2 + CH{\equiv}CH \rightarrow$ products									
Sulfur dioxide + Ethyne									
71 EIE/NOR	2			1550-2150	3.2(+10)	0.5	20535		
NOTE: Given with caution.									
$SO_2^{**} + CH_2{=}C{=}CH_2 \rightarrow$ products									
Sulfur dioxide + 1,2-Propadiene									
70 PAR/UEI	2		4.0	298	-	-	-		
NOTE: k_{ref}: $SO_2^{**} + CH_2{=}C{=}CH_2 \rightarrow$ CO + other products									
(SO_2^{**} is a non-emitting triplet).									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
$SO_2^*(^3B_1) + cis\text{-}CH_3CH{=}CHCH_3 \rightarrow [cis\text{-}CH_3CH{=}CHCH_3.SO_2]^*$									
Sulfur dioxide + cis-2-Butene									
Z4 DEM/CAL	2			294	1.3(+14)	-	-	0.9	1.1
$SO_2^*(^3B_1) + trans\text{-}CH_3CH{=}CHCH_3 \rightarrow [trans\text{-}CH_3CH{=}CHCH_3.SO_2]^*$									
Sulfur dioxide + trans-2-Butene									
Z4 DEM/CAL	2			294	1.2(+14)	-	-	0.9	1.1
$SO_2^*(^1B_1) + (CH_3)_3CH \rightarrow$ products									
Sulfur dioxide + Propane, 2-methyl-									
Z0 SU /CAL	2			298	8.4(+12)	-	-		
NOTE: Evaluation.									
$SO_2^*(^3B_1) + (CH_3)_3CH \rightarrow$ products									
Sulfur dioxide + Propane, 2-methyl-									
Z0 SU /CAL	2			298	8.7(+11)	-	-		
NOTE: Evaluation.									
$SO_2^*(^3B_1) + cis\text{-}CH_3CH_2CH{=}CHCH_3 \rightarrow [SO_2.CH_3CH_2CH{=}CHCH_3]^*$									
Sulfur dioxide + cis-2-Pentene									
Z6 WAM	2			295	6.3(+13)	-	-	0.8	1.2
$SO_2^*(^3B_1) + trans\text{-}CH_3CH_2CH{=}CHCH_3 \rightarrow [SO_2.CH_3CH_2CH{=}CHCH_3]^*$									
Sulfur dioxide + trans-2-Pentene									
Z6 WAM	2			295	1.0(+14)	-	-	0.7	1.3
$SO_2 + M \rightarrow SO + O + M$									
Sulfur dioxide									
Z9 GRI/REE	2	Ar		2800-3800	8.0(+15)	0	54350	0.7	1.3
$SO_3 + O \rightarrow SO_2 + O_2$									
Sulfur trioxide + Oxygen atom									
Z1 MER/LEV	2			1100-1400	6.5(+14)	0	5435		
NOTE: k determined in H_2S flame.									
	2			900-1600	2.8(+14)	0	6040		
k determined in COS flame.									
Z6 JAC/WIN	2			300-500	1.5(+8)	0	500		
Z9 MER/LEV	2			1685	1.5(+11)	-	-		

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$SO_3 + O + M \rightarrow SO_2 + O_2 + M$									
Sulfur trioxide + Oxygen atom									
Z9 WES/DEU1	3	He		290-507	5.0(+16)	0	-705	0.9	1.1
	3	He		298	7.3(+17)	-	-	0.9	1.1
NOTE: M_{eff}: He(1.0)									
	3	SO_3		298	(7.3(+18)	-	-		
M_{eff}: SO_3((10.0) Upper limit ratio.									
	3	N_2		298	1.0(+18)	-	-	0.9	1.1
M_{eff}: N_2(1.4)									
$SO_3 + H_2O \rightarrow H_2SO_4$									
Sulfur trioxide + Water									
Z5 COS/DAV	2			298	5.5(+11)	-	-	0.8	1.2
$SO_3 + SO \rightarrow SO_2 + SO_2$									
Sulfur trioxide + Sulfur monoxide									
Z5 CUV/GAL	2			298	1.2(+9)	-	-	0.4	1.6
$SO_3 + N \rightarrow SO_2 + NO$									
Sulfur trioxide + Nitrogen atom									
Z2 JAC/WIN	2			300	3.0(+8)	-	-		
Z5 WES/DEU1	2			298	(6.0(+6)	-	-		
NOTE: Upper limit k.									
$SO_3 + M \rightarrow SO_2 + O + M$									
Sulfur trioxide									
Z2 OSI/GLA	2	Ar		1700-2500	3.2(+15)	0	31900±300	0.6	1.6
$S_2O + O \rightarrow SO + SO$									
Sulfur oxide(S_2O) + Oxygen atom									
Z4 SIE/OLV	2			298	9.0(+11)	-	-	0.9	1.1
NOTE: Evaluation.									
$SH + O \rightarrow S + OH$									
Mercapto free radical + Oxygen atom									
Z5 WEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
$SH + O \rightarrow SO + H$									
Mercapto free radical + Oxygen atom									
Z5 WEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
Z5 CUP/GLA	2			295	9.6(+13)	-	-	0.7	1.3

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	F
SH + H → S + H_2									
Mercapto free radical + Hydrogen atom									
Z2 LAU/OLD	2			293	(6.0(+12)	-	-		
Z3 BRA/IRU	2			298	2.5(+13)	-	-		
Z5 CUP/GLA	2			298	1.5(+13)	-	-	0.7	1.3
Z6 BAU/DBY	2			298	1.5(+13)	-	-	0.5	1.5
NOTE: Recommended k.									
SH + H → H + SH									
Mercapto free radical + Hydrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
SH + S → H + S_2									
Mercapto free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation									
SH + S → S + SH									
Mercapto free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	4000		
NOTE: Semi-empirical evaluation.									
SH + SH → H_2S + S									
Mercapto free radical									
Z2 LAN/OLD	2			293	(1.8(+13)	-	-		
NOTE: Upper limit k.									
Z3 BRA/IRU	2			298	7.8(+12)	-	-		
Z6 BAU/DBY	2			295	7.8(+12)	-	-	0.5	1.5
NOTE: Recommended k.									
SH + N → H + NS									
Mercapto free radical + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	403		
NOTE: Semi-empirical evaluation.									
SH + N → S + NH									
Mercapto free radical + Nitrogen atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	9060		
NOTE: Semi-empirical evaluation.									
SH + NO → products									
Mercapto free radical + Nitrogen oxide(NO)									
Z3 BRA/IRU	2			298	6.3(+11)	-	-		
SH + C → H + CS									
Mercapto free radical + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
SH + C → S + CH									
Mercapto free radical + Carbon atom									
Z5 DEN/GOL	2				4.0(+11)	0.5	6090		
NOTE: Semi-empirical evaluation.									
H_2S + O → SH + OH									
Hydrogen sulfide + Oxygen atom									
Z6 WHY/TIM	2			263-495	4.4(+12)	0	1660±50	0.9	1.1
Z8 WUY/TIN	2			263-495	4.4(+12)	0	1660±50	0.8	1.2
D_2S + O → SD + OD									
Hydrogen sulfide(D_2S) + Oxygen atom									
Z6 WUY/TIN	2			298-450	6.3(+12)	0	2145±155	0.5	1.5
H_2S + O → products									
Hydrogen sulfide + Oxygen atom									
Z8 SLA/BAL	2			281-497	1.5(+13)	0	1920±45	0.9	1.1
NOTE: k based on editor's least square fit of 6 given experimental points.									
Z9 SIN/IRW	2			297-502	1.6(+13)	0	2171±202	0.5	1.5
H_2S + O_3 → SO_2 + H_2O									
Hydrogen sulfide + Ozone									
Z5 BCC/LNO	2			298	(1.2(+4)	-	-		
NOTE: Upper limit k. Unreported T assumed to be 298K.									
Z5 GLA/TOR1	2			293-343	4.9(+10)	0	3420		
NOTE: Estimated k.									
Z5 GLA/TOR2	2			298-343	1.6(+12)	0	2620±600	0.2	6.3
Z5 DOU/DRY	2			298	4.0(+2)	-	-	0.1	10.0
NOTE: Recommended k.									
H_2S + H → SH + H_2									
Hydrogen sulfide + Hydrogen atom									
Z1 KUR/PET	2			190-464	7.8(+12)	0	860±30	0.9	1.1
Z2 BOH/SCH	2			298	2.3(+11)	-	-	0.8	1.3
Z3 BRA/TRU	2			298	5.0(+11)	-	-		
Z6 DOU/DRY	2			190-470	7.0(+12)	0	860±50	0.5	1.5
NOTE: Recommended k.									
H_2S + OH → SH + H_2O									
Hydrogen sulfide + Hydroxyl free radical									
Z3 WES/DEU3	2			298-885	1.4(+13)	0	443		
Z4 SIU	2			298	1.9(+12)	-	-	0.8	1.2
Z6 DOU/DRY	2			298-900	6.3(+12)	0	200±150	0.7	1.3
NOTE: k factors changing to: f = 0.5 and F = 1.5 at 900K. Recommended k.									
Z6 PUB/OIK1	2			397-427	3.1(+12)	0	0	0.8	1.2

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$H_2S + OH \rightarrow$ products (overall)									
Hydrogen sulfide + Hydroxyl free radical									
Z2 NIK/MOR1	2			300	5.2(+12)	-	-		
NOTE: Approximate k.									
$H_2S + OH(v=9) \rightarrow$ products									
Hydrogen sulfide + Hydroxyl free radical									
Z2 WOR/COL	2			298	>1.5(+11)	-	-	0.6	1.4
NOTE: Lower limit k.									
. Unreported T assumed to be 298K.									
$H_2S + CH_3 \rightarrow SH + CH_4$									
Hydrogen sulfide + Methyl free radical									
Z6 KER/PAR	2			300-600	2.0(+11)	0	2065±150	0.4	2.5
NOTE: Tentative k value.									
$H_2S + M \rightarrow SH + H + M$									
Hydrogen sulfide									
Z6 WIG/SAI	2	Ar		2300-3000	1.3(+16)	0	46300		
Z2 BOW/DOD	2	Ar		2700-3800	2.0(+13)	0	37300±960	0.7	1.5
CS + O → S + CO									
Carbon monosulfide free radical + Oxygen atom									
Z1 HAN/SMI	2			298	8.4(+12)	-	-		
NOTE: Evaluation.									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
Z0 KOL	2			300	1.3(+13)	-	-	0.8	1.2
NOTE: Unreported T assumed to be 300K.									
CS + O → S + CO(v=n)									
Carbon monosulfide free radical + Oxygen atom									
Z2 HAN/RID	2		0.1	298	-	-	-		
NOTE: k_{ref}: CS + O → S + CO(v=13)									
Ratio increasing from 0.1 to 0.9 between v=7 and v=12, then decreasing to 0.3 from v=14 to v=15.									
Unreported T assumed to be 298K.									
Z5 SLA/GRA1	2			305	1.2(+13)	-	-	0.9	1.1
Z4 WID/BRE	2			300	1.4(+13)	-	-	0.8	1.2
CS + O → SH + C									
Carbon monosulfide free radical + Oxygen atom									
Z5 BEN/GOL	2				1.6(+12)	0.5	28940		
NOTE: Semi-empirical evaluation.									
CS + H → S + CH									
Carbon monosulfide free radical + Hydrogen atom									
Z5 BEN/GOL	2				1.3(+13)	.0.5	50930		
NOTE: Semi-empirical evaluation.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
CS + H → SH + C									
Carbon monosulfide free radical + Hydrogen atom									
Z5 BEN/GOL	2				2.0(+13)	0.5	40870		
NOTE: Semi-empirical evaluation.									
CS + S → S + CS									
Carbon monosulfide free radical + Sulfur atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
CS + S → C + S_2									
Carbon monosulfide free radical + Sulfur atom									
Z5 BEN/GOL	2				1.6(+12)	0.5	40463		
NOTE: Semi-empirical evaluation.									
CS + S + M → CS_2 + M									
Carbon monosulfide free radical + Sulfur atom									
Z6 BOU/DRY	3			1800-3700	8.7(+13)	0	4370	0.5	1.5
NOTE: $k_1 = Kk_{-1}$									
Recommended k.									
CS + N → S + CN									
Carbon monosulfide free radical + Nitrogen atom									
Z5 BEN/GOL	2				1.3(+12)	0.5	1160		
NOTE: Semi-empirical evaluation.									
CS + N → C + NS									
Carbon monosulfide free radical + Nitrogen atom									
Z5 BEN/GOL	2				4.0(+12)	0.5	37200		
NOTE: Semi-empirical evaluation.									
CS + C → S + C_2									
Carbon monosulfide free radical + Carbon atom									
Z5 BEN/GOL	2				5.0(+11)	0.5	20435		
NOTE: Semi-empirical evaluation.									
CS + C → C + CS									
Carbon monosulfide free radical + Carbon atom									
Z5 BEN/GOL	2				6.3(+11)	0.5	0		
NOTE: Semi-empirical evaluation.									
CS_2 + O → CS + SO									
Carbon disulfide + Oxygen atom									
Z1 IAK	2			298	1.4(+12)	-	-	0.9	1.1
Z5 WEI/TIM	2			210-293	1.7(+13)	0	645±35	0.9	1.1
Z6 BOU/DRY	2			200-1000	2.2(+13)	0	700	0.7	1.3
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$CS_2 + O \rightarrow COS + S$									
Carbon disulfide + Oxygen atom									
Z4 SLA/GIL	2		0.093	302	-	-	-		
NOTE: k_{ref}: $CS_2 + O \rightarrow$ products									
Z6 BAU/DRY	2			302	2.2(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
Z7 GRA/GUT	2		0.090	249-500	-	-	-		
NOTE: k_{ref}: $CS_2 + O \rightarrow$ products									
within the given T range, the k/k_{ref} ratio decreases from 0.090±0.004 at 249K to 0.081±0.007 at 500K.									
	2			249-500	1.7(+11)	-	-	0.9	1.2
NOTE: Within the given T range, k increases from 1.7×10^{11} at 249K to 5.5×10^{11} $cm^3 mol^{-1} s^{-1}$ at 500K.									
$CS_2 + O \rightarrow$ products									
Carbon disulfide + Oxygen atom									
Z4 SLA/GIL	2			302	2.4(+12)	-	-		
Z4 GRA/GUT	2			249-500	1.7(+12)	-	-	0.9	1.1
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increases from 1.7×10^{12} at 249K to 6.7×10^{12} $cm^3 mol^{-1} s^{-1}$ at 500K.									
$CS_2 + OH \rightarrow$ products									
Carbon disulfide + Hydroxyl free radical									
Z0 AIK/PLR1	2			300	(4.2(+10)	-	-		
NOTE: Upper limit k.	2			425	(6.0(+10)	-	-		
NOTE: Upper limit k.									
Z0 KUR2	2			296	1.1(+11)	-	-	0.8	1.2
$CS_2 + S \rightarrow CS + S_2$									
Carbon disulfide + Sulfur atom									
Z6 BAU/DRY	2			298	3.9(+11)	-	-	0.5	1.5
NOTE: Recommended k.									
$CS_2 + M \rightarrow CS + S + M$									
Carbon disulfide									
Z6 BAU/DRY	2	Ar		1800-3700	2.6(+15)	0	30960±9000	0.5	1.5
NOTE: Recommended k.									
$CS_2 + M \rightarrow$ products									
Carbon disulfide									
Z4 IRA	2				6.8(+14)	0	36000±700		
NOTE: k measured in shock tube. Unspecified high T range.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
COS + O → SO + CO									
Carbon oxide sulfide + Oxygen atom									
Z1 KRE	2			300-523	9.8(+12)	0	2265		
Z1 KRE/SIM	2			300-523	9.8(+12)	0	2265		
Z4 KLE/SII	2			263-502	9.9(+12)	0	2167±20	0.9	1.1
Z5 WEI/IIM	2			239-404	1.2(+13)	0	2150±35	0.8	1.2
Z4 BAU/DRY	2			190-1200	1.6(+13)	0	2250±250	0.5	1.5
NOTE: k factors changing to: f = 0.3 and F = 3.0 above 300K. Recommended k.									
COS + $O^*(^1D)$ → SO + CO									
Carbon oxide sulfide + Oxygen atom									
Z5 GU/SNE	2		4.1	300	-	-	-		
NOTE: k_{ref}: $O_2 + O^*(^1D) \rightarrow O_2^*(^1\Sigma_g^+) + O$									
	2			300	1.8(+14)	-	-		
NOTE: Evaluation.									
COS + H → CO + SH									
Carbon oxide sulfide + Hydrogen atom									
Z2 ROD/SGU	2			298	1.3(+10)	-	-	0.8	1.3
Z5 ISU/YOK	2			300-525	9.1(+12)	0	1965±105	0.9	1.1
Z6 BAU/DRY	2			298	1.3(+10)	-	-	0.8	1.3
NOTE: Recommended k.									
Z4 LEE	2			298-478	9.8(+13)	0	2775±40	0.9	1.1
Z2 LEE/SII	2			261-500	5.5(+12)	0	1940±55	0.8	1.2
COS + OH → products									
Carbon oxide sulfide + Hydroxyl free radical									
Z0 AIK/PER1	2			299	(4.2(+9)	-	-		
NOTE: Upper limit k.									
	2			430	(1.2(+10)	-	-		
NOTE: Upper limit k.									
Z0 KUR2	2			296	3.4(+10)	-	-		
COS + OH(v=9) → products									
Carbon oxide sulfide + Hydroxyl free radical									
Z2 WOR/COL	2			298	1.5(+10)	-	-	0.4	1.6
NOTE: Unreported T assumed to be 298K.									
COS + S → CO + S_2									
Carbon oxide sulfide + Sulfur atom									
Z2 JAK/AUM	2			298	1.1(+10)	-	-		
NOTE: Evaluation.									
Z4 KLE/DAV	2			233-245	9.2(+11)	0	1025±60	0.9	1.1
Z4 BAU/DRY	2			230-2600	1.7(+12)	0	2050±230	0.3	3.0
NOTE: Recommended k.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$COS + S^*(^1D) \rightarrow CO + S_2$									
Carbon oxide sulfide + Sulfur atom									
ZZ LII/PAL	2		1.5	300	-	-	-		
NOTE: k_{ref}: $CH_2=CH_2 + S^*(^1D) \rightarrow$ products									
$COS + CD_3 \rightarrow CO + CD_3S$									
Carbon oxide sulfide + Methyl-d_3 free radical									
ZZ JAK/AUM	2			354-490	3.8(+11)	0	5710±175	0.6	1.8
NOTE: Evaluation.									
$COS + CN \rightarrow SCN + CO$									
Carbon oxide sulfide + Cyanogen free radical									
ZZ ADD/LEI	2			295	>1.8(+13)	-	-		
NOTE: Lower limit k.									
$COS + M \rightarrow$ products									
Carbon oxide sulfide									
ZA IBA	2				8.3(+14)	0	31700±650		
NOTE: k measured in shock tube. Unspecified, high T range.									
$CH_3S^* + CH{\equiv}CH \rightarrow CH_3SCH{=}CH^*$									
Methylthio free radical + Ethyne									
ZZ KER/PAR	2			298-333	7.9(+7)	-	-		
NOTE: Recommended k.									
$CH_3S^* + CH_2=CH_2 \rightarrow CH_3SCH_2CH_2^*$									
Methylthio free radical + Ethene									
ZZ KER/PAR	2			298	4.8(+8)	-	-		
NOTE: Recommended k.									
$CH_3S^* + cy\text{-}CH_2CH_2S \rightarrow CH_3S_2^* + CH_2=CH_2$									
Methylthio free radical + Thiirane									
ZZ JAK/AUM	2			304-478	3.2(+11)	0	4430		
NOTE: Approximate k.									
$CH_3S^* + CH_3CH{=}CHCH_3 \rightarrow CH_3CH(SCH_3)CH(^*)CH_3$									
Methylthio free radical + 2-Butene									
ZZ KER/PAR	2			298-333	1.6(+9)	-	-		
NOTE: cis-trans equilibrium-weighted k.									
$CH_3SH \rightarrow CH_3 + SH$									
Methanethiol									
ZU PEN/O'N	1			1005-1102	3.2(+15)	0	38550		
NOTE: Critical evaluation.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	E/R (in K)	k factors f	k factors F
$CH_3SH + O \rightarrow CH_3^{\cdot} + HS(O)^{\cdot} + CH_3S(O)^{\cdot} + H + CH_3S^{\cdot} + CH_3O^{\cdot}$									
Methanethiol + Oxygen atom									
Z6 SLA/GRA	2			300	1.1(+12)	-	-		
Z0 SLA/POL	2			254-495	1.1(+12)	-	-		
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increasing from 1.1×10^{12} at 254K to 2.6×10^{12} $cm^3mol^{-1}s^{-1}$ at 495K.									
$CH_3SH + CH_3^{\cdot} \rightarrow {}^{\cdot}CH_2SH + CH_4$									
Methanethiol + Methyl free radical									
Z6 KER/POR	2			303	1.2(+8)	-	-	0.5	2.0
NOTE: Recommended k.									
$CD_3SH + CH_3^{\cdot} \rightarrow CD_3S^{\cdot} + CH_4$									
Methane-d_3-thiol + Methyl free radical									
Z6 KER/POR	2			400-500	1.1(+11)	0	2065±500	0.5	2.0
NOTE: Recommended k.									
$CD_3SH + CH_3^{\cdot} \rightarrow {}^{\cdot}CD_2SH + CH_3D$									
Methane-d_3-thiol + Methyl free radical									
Z6 KER/POR	2			400-500	7.6(+10)	0	4200±250	0.5	2.0
NOTE: Recommended k.									
$cy\text{-}CH_2CH_2S + O \rightarrow CH_2{=}CH_2 + SO$									
Thiirane + Oxygen atom									
Z6 LLE/TIM	2			260-424	8.1(+12)	0	10±20	0.9	1.1
$cy\text{-}CH_2CH_2S + H \rightarrow CH_2{=}CH_2 + SH$									
Thiirane + Hydrogen atom									
Z6 YOK/OUM	2			300-425	5.7(+13)	0	978±00	0.9	1.1
$cy\text{-}CH_2SCH_2 + H \rightarrow cy\text{-}CH_2SCH^{\cdot} + H_2$									
Thiirane + Hydrogen atom									
Z6 LEE	2			298	7.1(+11)	-	-	0.8	1.2
$cy\text{-}CH_2CH_2S + S \rightarrow CH_2{=}CH_2 + S_2$									
Thiirane + Sulfur atom									
Z1 SIR/OYC	2			298-450	-	-	-		
NOTE: k/k_{ref} = 0.3exp(+906/T) k_{ref}: $CH_2{=}CH_2 + S \rightarrow cy\text{-}CH_2CH_2S$ Conventional photolysis method.									
Z1 KLE/DAV1	2			298-355	2.7(+13)	0	0	0.9	1.1

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	k factors F
$cy\text{-}CH_2CH_2S + CH_3^{\cdot} \rightarrow CH_2{=}CH_2 + CH_3S^{\cdot}$									
Thiirane + Methyl free radical									
Z2 JAK/AUM	2			304-478	7.1(+10)	0	3370±400	0.3	3.3
$cy\text{-}CH_2CH_2S + CD_3^{\cdot} \rightarrow CH_2{=}CH_2 + CD_3S^{\cdot}$									
Thiirane + Methyl-d_3 free radical									
Z2 JAK/AUM	2			303-477	5.9(+10)	0	3270±500	0.2	4.4
NOTE: Evaluation.									
$cy\text{-}CH_2CH_2S + CD_3^{\cdot} \rightarrow cy\text{-}CH_2CH(^{\cdot})S + CD_3H$									
Thiirane + Methyl-d_3 free radical									
Z2 JAK/AUM	2			303-477	2.2(+11)	0	4800±500	0.3	4.0
NOTE: Evaluation.									
Z0 KER/CAR	2			300-500	2.2(+11)	0	4800±500	0.5	2.0
NOTE: Recommended k.									
$cy\text{-}CH_2CH_2S + CH_3S^{\cdot} \rightarrow CH_2{=}CH_2 + CH_3S_2^{\cdot}$									
Thiirane + Methylthio free radical									
Z2 JAK/AUM	2			304-478	3.2(+11)	0	4430		
NOTE: Approximate k.									
$CH_3SCH_2^{\cdot} + CH_4 \rightarrow (CH_3)_2S + CH_3$									
Methyl, (methylthio)-, free radical + Methane									
Z0 ABI/LLE	2			393-518	6.3(+11)	0	7662		
NOTE: Evaluation based on k_{-1} and thermodynamic data.									
$CH_3CH_2SH \rightarrow CH_2{=}CH_2 + H_2S$									
Ethanethiol									
Z0 BEN/O'N	1			785-930	1.0(+13)	0	25900		
NOTE: Critical evaluation.									
$CH_3CH_2SH \rightarrow CH_3CH_2^{\cdot} + SH$									
Ethanethiol									
Z0 BEN/O'N	1			785-930	6.3(+15)	0	36336		
NOTE: Critical evaluation.									
$CH_3CH_2SH + O \rightarrow CH_3CH_2^{\cdot} + HS(O)^{\cdot} + CH_3CH_2S(O)^{\cdot} + H$									
Ethanethiol + Oxygen atom									
Z0 SLO/GRO	2			300	1.7(+12)	-	-		
Z0 SLO/PLO	2			257-495	1.9(+12)	-	-		
NOTE: Non-linear Arrhenius behavior. Within the given T range, k increasing from 1.9×10^{12} at 257K to 3.2×10^{12} $cm^3mol^{-1}s^{-1}$ at 495K.									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
$H_3CH_2SH + CH_3 \rightarrow$ products									
Ethanethiol + Methyl free radical									
Z6 KER/PAR				304	3.5(+7)	–	–	1.5	2.0
NOTE: Tentative k.									
$(CH_3)_2S + O \rightarrow CH_3S(O)^{\cdot} + CH_3$									
Methane, thiobis-, + Oxygen atom									
Z6 LEE/LIM	2			260-424	0.6(+12)	0	-366±16	1.9	1.1
Z6 SLA/GKD				300	3.0(+13)	–	–		
Z6 SLA/BAL	2			252-493	3.0(+13)	–	–		
NOTE: Possible non-linear Arrhenius behavior within the given T range, k decreasing from 3.0×10^{13} at 252K to 2.2×10^{13} $cm^3 mol^{-1} s^{-1}$ at 493K.									
$(CH_3)_2S + O \rightarrow$ products									
Methane, thiobis-, + Oxygen atom									
Z4 CAD/WIC	2			300	3.3(+11)	–	–		
$(CH_3)_2S + O_3 \rightarrow$ PRODUCTS									
Methane, thiobis-, + Ozone									
Z6 BAR/HER	2			296	<5.0(+5)	–	–		
NOTE: Upper limit k.									
$(CH_3)_2S + H \rightarrow CH_3SH + CH_3$									
Methane, thiobis-, + Hydrogen atom									
Z2 YOK/SIR	2			300-472	1.7(+13)	0	1320±44	1.8	1.2
$(CH_3)_2S + H \rightarrow CH_3SCH_2^{\cdot} + H_2$									
Methane, thiobis-, + Hydrogen atom									
Z6 LEE				300	9.0(+10)	–	–	1.7	1.3
$(CH_3)_2S + OH \rightarrow$ PRODUCTS									
Methane, thiobis-, + Hydroxyl free radical									
Z6 AIK/PER1	2			300	5.9(+12)	–	–	1.9	1.1
	2			299-430	3.3(+12)	0	-179±150		
Z6 KUR1	2			273-426	3.7(+12)	0.	134±135	1.6	1.4
NOTE: Recommended k.									
$(CH_3)_2S + CH_3 \rightarrow CH_3SCH_2^{\cdot} + CH_4$									
Methane, thiobis-, + Methyl free radical									
Z6 ARI/LEE	2			393-510	4.2(+11)	0	4613±82	1.8	1.2
$CH_3SO_2CH_3 \rightarrow CH_3SO_2^{\cdot} + CH_3$									
Methane, sulfonylbis-									
Z6 BEN/O'N	1			783-913	2.0(+14)	0	30500		
NOTE: Critical evaluation									

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f	F
cy-$CH_2CH_2CH_2S$ + CH_3 → cy-$CH_2CH(\cdot)CH_2S$ + CH_4									
Thietane + Methyl free radical									
Z6 KER/PAR	1			300-450	3.2(+11)	0	4630±750		
NOTE: Tentative k.									
cy-$(CH_3)CHCH_2S$ + S → $CH_3CH{=}CH_2$ + S_2									
Thiirane, methyl-, + Sulfur atom									
Z1 SIR/O'C	2			290-450	-	-	-		
NOTE: k/k_{ref} = 0.4exp(1057/T)									
k_{ref}: $CH_2{=}CH_2$ + S → cy-CH_2CH_2S									
Conventional photolysis method.									
cy-$(CH_3)CHCH_2S$ + CH_3 → $CH_3CH{=}CH_2$ + CH_3S									
Thiirane, methyl-, + Methyl free radical									
Z2 JAK/AUM	2			339-435	2.1(+11)	0	3750±830	0.1	0.3
NOTE: Evaluation.									
cy-$(CH_3)CHCH_2S$ + CH_3 → cy-$[(CH_2\cdot)CHCH_2]S$ + CH_4									
Thiirane, methyl-, + Methyl free radical									
Z2 JAK/AUM	2			339-435	1.0(+11)	0	4160±440	0.3	3.0
$(CH_3)_2CHSH$ + CH_3 → products									
2-Propanethiol + Methyl free radical									
Z6 KER/PAR	2			303	4.1(+7)	-	-		
NOTE: Tentative k.									
cy-$CH_2CH_2CH_2CH_2S$ + H → $\cdot CH_2CH_2CH_2CH_2SH$									
Thiophene, tetrahydro-, + Hydrogen atom									
Z0 HOR/NIS	2			295-576	0.5(+12)	0	1010		
NOTE: At 5 torr.									
$CH_3C(S)SCH_2CH_3$ → CH_4 + CS_2 + $CH_2{=}CH_2$									
Ethane(dithioic) acid ethyl ester									
Z0 ALA/BIG	1			629	1.8(-3)	-	-		
	1			651-716	9.2(+12)	0	22730		
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$									
$CH_3CH_2CH_2CH_2SH$ + H → $CH_3CH_2CH_2CH_2\cdot$ + H_2S									
Butanethiol + Hydrogen atom									
Z0 HOR/NIS	2			295-576	1.6(+12)	0	1120		
NOTE: At 5 torr.									
$CH_3CH_2CH_2CH_2SH$ + H → $CH_3CH_2CH_2CH_2S\cdot$ + H_2									
Butanethiol + Hydrogen atom									
Z0 HOR/NIS	2			295-576	1.3(+13)	0	1600		
NOTE: At 5 torr.									

CHEMICAL REACTIONS	n	M	k/k$_{ref}$	T/K	A	B	-E/R (in K)	k factors f F
$(CH_3)_3CSH \rightarrow (CH_3)_2C{=}CH_2 + H_2S$								
2-Propanethiol, 2-methyl-								
ZQ KEN/O'N	1			950-1230	2.5(+13)	0	27830	
NOTE: Critical evaluation.								
$(CH_3)_3CSH + CH_3 \rightarrow (CH_3)_3CS\cdot + \cdot CH_2C(CH_3)_2SH + CH_4$								
2-Propanethiol, 2-methyl-, + Methyl free radical								
ZG KER/PAR	2			303	5.9(+7)	-	-	
NOTE: Tentative k.								
$CH_2{=}CHCH_2SO_2CH_3 \rightarrow CH_2{=}CHCH_2\cdot + CH_3SO_2\cdot$								
1-Propene, 3-methylsulfonyl-								
ZQ KEN/O'N	1			573-633	5.0(+12)	0	20030	
NOTE: Critical evaluation.								
$CH_3SC(O)OCH_2CH_3 \rightarrow CH_3SH + CO_2 + CH_2{=}CH_2$								
Carbonothioic acid O-ethyl S-methyl ester								
ZZ OLA/BIG	1			629	1.0(-4)	-	-	
	1			490-550	1.8(+12)	0	23500	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3OC(O)SCH_2CH_3 \rightarrow CH_3OH + COS + CH_2{=}CH_2$								
Carbonothioic acid S-ethyl O-methyl ester								
ZZ ALA/BIG	1			629	7.8(-7)	-	-	
	1			490-550	1.2(+13)	0	27800	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3OC(O)SCH(CH_3)_2 \rightarrow CH_3OH + COS + CH_3CH{=}CH_2$								
Carbonothioic acid O-methyl S-(1-methylethyl) ester								
ZZ OLA/BIG	1			629	4.6(-5)	-	-	
	1			440-480	8.4(+12)	0	25000	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3SC(O)OCH(CH_3)_2 \rightarrow CH_3SH + CO_2 + CH_3CH{=}CH_2$								
Carbonothioic acid S-methyl O-(1-methylethyl) ester								
ZZ OLA/BIG	1			629	9.4(-3)	-	-	
	1			547-584	6.7(+11)	0	20060	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$. (Evacuated sealed tube method).								
$CH_3SC(O)OC(CH_3)_3 \rightarrow CH_3SH + CO_2 + CH_2{=}C(CH_3)_2$								
Carbonothioic acid O-(1,1-dimethylethyl) S-methyl ester								
ZZ OLA/BIG	1			629	4.2(-1)	-	-	
	1			479-502	5.4(+10)	0	16080	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$. (Inhibited sealed tube method).								

CHEMICAL REACTIONS	n	M	k/k_{ref}	T/K	A	B	E/R (in K)	k factors f F
$CH_3OC(O)SC(CH_3)_3 \rightarrow CH_3OH + COS + CH_2{=}C(CH_3)_2$								
Carbonothioic acid S-(1,1-dimethylethyl) O-methyl ester								
ZZ ALA/BIG	1			629	1.2(-3)	-	-	
	1			370-420	1.4(+12)	0	21800	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SCH_2CH_2CH_2CH_3 \rightarrow CH_4 + CS_2 + CH_2{=}CHCH_2CH_3$								
Ethane(dithioic) acid butyl ester								
ZZ ALA/BIG	1			629	3.3(-3)	-	-	
	1			651-716	1.2(+13)	0	22500	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SCH(CH_3)CH_2CH_3 \rightarrow CH_4 + CS_2 + CH_2{=}CHCH_2CH_3$ + cis-, and trans-$CH_3CH{=}CHCH_3$								
Ethane(dithioic) acid 1-methylpropyl ester								
ZZ ALA/BIG	1			629	7.4(-2)	-	-	
	1			584-639	6.7(+12)	0	20210	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								
$CH_3C(S)SC(CH_3)_3 \rightarrow CH_4 + CS_2 + (CH_3)_2C{=}CH_2$								
Ethane(dithioic) acid 1,1-dimethylethyl ester								
ZZ ALA/BIG	1			629	3.1(-1)	-	-	
	1			448-502	1.1(+13)	0	19600	
NOTE: k based on reported $\Delta H^{\ddagger}$ and $\Delta S^{\ddagger}$.								

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APPENDIX: CONVERSION TABLES

EQUIVALENT SECOND ORDER RATE CONSTANTS

A \ B	$cm^3 mol^{-1} s^{-1}$	$dm^3 mol^{-1} s^{-1}$	$m^3 mol^{-1} s^{-1}$	$cm^3 molecule^{-1} s^{-1}$	$(mm\ Hg)^{-1} s^{-1}$	$atm^{-1} s^{-1}$	$ppm^{-1} min^{-1}$	$m^2 kN^{-1} s^{-1}$
1 $cm^3 mol^{-1} s^{-1}$ =	1	10^{-3}	10^{-6}	1.66×10^{-24}	$1.604 \times 10^{-5} T^{-1}$	$1.219 \times 10^{-2} T^{-1}$	2.453×10^{-9}	$1.203 \times 10^{-4} T^{-1}$
1 $dm^3 mol^{-1} s^{-1}$ =	10^3	1	10^{-3}	1.66×10^{-21}	$1.604 \times 10^{-2} T^{-1}$	$12.19\ T^{-1}$	2.453×10^{-6}	$1.203 \times 10^{-1} T^{-1}$
1 $m^3 mol^{-1} s^{-1}$ =	10^6	10^3	1	1.66×10^{-18}	$16.04\ T^{-1}$	$1.219 \times 10^4 T^{-1}$	2.453×10^{-3}	$120.3\ T^{-1}$
1 $cm^3 molecule^{-1} s^{-1}$ =	6.023×10^{23}	6.023×10^{20}	6.023×10^{17}	1	$9.658 \times 10^{18} T^{-1}$	$7.34 \times 10^{21} T^{-1}$	1.478×10^{15}	$7.244 \times 10^{19} T^{-1}$
1 $(mm\ Hg)^{-1} s^{-1}$ =	$6.236 \times 10^4 T$	$62.36\ T$	$6.236 \times 10^{-2} T$	$1.035 \times 10^{-19} T$	1	760	4.56×10^{-2}	7.500
1 $atm^{-1} s^{-1}$ =	$82.06\ T$	$8.206 \times 10^{-2} T$	$8.206 \times 10^{-5} T$	$1.362 \times 10^{-22} T$	1.316×10^{-3}	1	6×10^{-5}	9.869×10^{-3}
1 $ppm^{-1} min^{-1}$ = at 298K, 1 atm. total pressure	4.077×10^8	4.077×10^5	407.7	6.76×10^{-16}	21.93	1.667×10^4	1	164.5
1 $m^2 kN^{-1} s^{-1}$ =	$8314\ T$	$8.314\ T$	$8.314 \times 10^{-3} T$	$1.38 \times 10^{-20} T$	0.1333	101.325	6.079×10^{-3}	1

To convert a rate constant from one set of units A to a new set B find the conversion factor for the row A under Column B, and multiply the old value by it, e.g. to convert $cm^3 molecule^{-1} s^{-1}$ to $m^3 mol^{-1} s^{-1}$ multiply by 6.023×10^{17}.

Table adapted from Evaluated Kinetic Data for High Temperature Reactions, Volume 1: Homogeneous Gas Phase Reactions of the H_2-O_2 System, Butterworths, London, 1972.

EQUIVALENT THIRD ORDER RATE CONSTANTS

A \ B	$cm^6 mol^{-2} s^{-1}$	$dm^6 mol^{-2} s^{-1}$	$m^6 mol^{-2} s^{-1}$	$cm^6 molecule^{-2} s^{-1}$	$(mm\ Hg)^{-2} s^{-1}$	$atm^{-2} s^{-1}$	$ppm^{-2} min^{-1}$	$m^4 kN^{-2} s^{-1}$
1 $cm^6 mol^{-2} s^{-1}$ =	1	10^{-6}	10^{-12}	2.76×10^{-48}	$2.57 \times 10^{-10} T^{-2}$	$1.48 \times 10^{-4} T^{-2}$	1.003×10^{-19}	$1.447 \times 10^{-8} T^{-2}$
1 $dm^6 mol^{-2} s^{-1}$ =	10^6	1	10^{-6}	2.76×10^{-42}	$2.57 \times 10^{-4} T^{-2}$	$148\ T^{-2}$	1.003×10^{-13}	$1.447 \times 10^{-2} T^{-2}$
1 $m^6 mol^{-2} s^{-1}$ =	10^{12}	10^6	1	2.76×10^{-36}	$257\ T^{-2}$	$1.48 \times 10^{8} T^{-2}$	1.003×10^{-7}	$1.447 \times 10^{4} T^{-2}$
1 $cm^6 molecule^{-2} s^{-1}$ =	3.628×10^{47}	3.628×10^{41}	3.628×10^{35}	1	$9.328 \times 10^{37} T^{-2}$	$5.388 \times 10^{43} T^{-2}$	3.64×10^{28}	$5.248 \times 10^{39} T^{-2}$
1 $(mm\ Hg)^{-2} s^{-1}$ =	$3.89 \times 10^{9} T^2$	$3.89 \times 10^{3} T^2$	$3.89 \times 10^{-3} T^2$	$1.07 \times 10^{-38} T^2$	1	5.776×10^{5}	3.46×10^{-5}	56.25
1 $atm^{-2} s^{-1}$ =	$6.733 \times 10^{3} T^2$	$6.733 \times 10^{-3} T^2$	$6.733 \times 10^{-9} T^2$	$1.86 \times 10^{-44} T^2$	1.73×10^{-6}	1	6×10^{-11}	9.74×10^{-5}
1 $ppm^{-2} min^{-1}$ = at 298K, 1 atm. total pressure	9.97×10^{18}	9.97×10^{12}	9.97×10^{6}	2.75×10^{-29}	2.89×10^{4}	1.667×10^{10}	1	1.623×10^{6}
1 $m^4 kN^{-2} s^{-1}$ =	$6.91 \times 10^{7} T^2$	$69.1\ T^2$	$6.91 \times 10^{-5} T^2$	$1.904 \times 10^{-40} T^2$	0.0178	1.027×10^{4}	6.16×10^{-7}	1

See note to Table for Second Order Rate Constants

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☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

A table of rate constants for gas phase chemical reactions of sulfur compounds is presented. Specifically, it gives in tabular form the values of the parameters for the modified Arrhenius equation $k = AT^B \exp(-E/RT)$. The table covers the reactions of sulfur containing molecules and free radicals - S, S_2, SO, SO_2, SO_3, S_2O, SH, H_2S, CS, CS_2, COS, $CH_3S\cdot$, CH_3SH, cy-CH_2CH_2S, $CH_3SCH_2\cdot$ and a number of thiols, thioethers and thioesters - with other compounds. The table includes 16 unimolecular, 187 bimolecular, and 11 termolecular reactions totalling 214 distinct chemical reactions. There are 348 distinct entries, distributed as follows: 26 for first order reactions, 294 for second order reactions and 28 for third order reactions. The kinetic data were compiled from 109 experimental papers and 6 critical reviews published between 1970 and 1979.

17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)
Arrhenius parameters, chemical kinetics, combustion, decomposition, free radicals, gas phase, hydrocarbons, hydrogen, nitrogen oxygen, rate of reaction, sulfur.

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